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Process for manufacturing pneumatic tires and relative device.

(57)

Process and drum for blocking the carcass plies against the bead cores of a tire, said process comprising the steps of expanding in a first cylindrical configuration the carcass plies against the inner surface of the bead cores, of moving the bead cores near each other along the axis of the carcass together with the portions of the carcass plies already blocked with invariable configuration with respect to the inner surfaces of the bead cores, and of expanding further on in cylindrical configuration the carcass plies at the sides of the bead cores. By means of the cited steps it is possible to avoid sliding of the carcass plies on the bead cores in the toric configuration of the carcass and to obtain beads of equal rigidity.

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1 PROCESS FOR MANUFACTURING PNEUMATIC TIRES AND RELATIVE
DEVICE

5 The present invention refers to a process and its relative device for manufacturing tires and more particularly for manufacturing tires comprising a radial carcass, a tread and an annular reinforcing structure between the carcass and the tread.

10 As known, to build up the carcass, at first there is formed a cylindrical sleeve of the carcass ply or plies and then the cylindrical sleeve is shaped to toric configuration. Subsequently the annular reinforcing structure and the tread are applied to the carcass.

15 According to a known solution, this process is accomplished with only one expandable drum constituted substantially by three bladders placed side by side, on which all the elements constituting the carcass are arranged. Said
20 elements are mainly the sidewalls, the reinforcing strips and the carcass plies.

On the so formed sleeve and at a predetermined distance from the ends thereof there are arranged the bead cores,
25 and the zones of the drum near the bead cores are expanded so that the carcass plies are brought against the inner surface of the bead cores.

30 In a further step the central bladder is inflated and the bead cores are simultaneously drawn in axial sense toward each other so as to torically shaping the carcass, and at last the lateral bladders are inflated causing the turn-up of all the elements previously arranged around
35 the bead cores.

- 1 Subsequently, as already said, the annular reinforcing structure and the tread are applied to the carcass.

Unfortunately, this process is unsatisfactory in some cases, in particular, as verified, owing to possible sliding of the carcass plies around the bead cores during the expansion of the central bladder for the toric shaping of the carcass to toric configuration.

- 10 Generally, the cited drawback can take place with any whatsoever type of carcass, but more frequently when the carcass is constituted by a plurality of plies or by a metallic ply; in fact it is considered that to a higher bending stiffness of the carcass plies corresponds a lesser capacity of the plies to become deformed for following the profile of the bead cores when the building drum is expanded to press the plies between the bead core and the bead seat purposely provided on the drum.

- 20 Consequently during the expansion of the central bladder, just when the thrusts on the carcass are more intense, there can occur a sliding of the outermost ply with respect to the innermost one around the bead cores and also dissimilar slidings in the two beads.

25 As it can be understood, to the sliding of the ply corresponds a resistant structure of the bead different from the wished optimal one and/or also a geometrical configuration different between the two beads and unacceptable.

Also there is a further solution of a process for manufacturing a pneumatic tire, known as two step building up and based on the use of two drums instead of only one

1 drum as in the single step process mentioned before.

According to this solution the carcass is formed to
cylindrical configuration on a first rigid collapsible
5 drum.

The bead cores are then applied to the carcass plies at
the shoulders of the drum, usually of the "undercut"
type to permit the bead of the carcass to be made already
10 in the final configuration of the pneumatic tire, i.e. in
such a way that only the part of the carcass having
cylindrical configuration and arranged on the outer
surface of the drum between the shoulders, becomes
subjected to a shaping to toric configuration on a second
15 expandable drum.

However, also in this solution there result sometimes,
in the case of carcasses having a certain bending stiff-
ness, an imperfect adaptation of the plies on the drum
20 shoulders and an inexact construction of the beads or
also a different construction between bead and bead.

In the subsequent toric configuration either for the
cited reasons or for a combination with other not easily
25 explainable conditions, slidings of the plies around the
bead cores happened again.

The two step building up process could still be carried
out with two drums, the first of which in practically
30 flat configuration without shoulders of "undercut" type.
In this case the carcass is practically cylindrical for
its whole length from bead to bead.

- 1 Unfortunately, in the subsequent step on the second drum,
owing to the expansion of the carcass, the zone of the
beads is obliged to rotate for passing from the cylindric-
al configuration received on the flat drum to the toric
5 one of the carcass profile in formation.

Consequently the carcass is subjected to stresses in the
zone nearer the bead cores with strong deformations of
the beads and slidings between the carcass ply or plies
10 and the bead cores.

It can be thought to oppose the tendency of sliding of
the plies by making recourse to the use of suitable bells
or rings whose inner profile is such as to mate faithfully
15 and to press the beads during the shaping to toric con-
figuration of the carcass on the expandable drum stronger
to the carcass profile, i.e. by blocking the plies against
the bead cores when the inflation pressures are higher.

20 As it can be understood, it is necessary to provide
particular equipment supplementary to the drum for perform-
ing the second step, together with specific means for
synchronism and movement of the two bells, means, as it
can be easily understood, preferably to be avoided.

25 On the other hand, the cited equipment has a limited
field of use, possibly for radial tires of simple manu-
facture usually for textile monople carcasses.

30 Consequently, all the cited solutions, in particular for
the construction of tires having multiply or metallic
carcass, appear unsuitable for effecting a reliable block-
ing between the carcass plies being in cylindrical
configuration and the bead cores and this circumstance
35

1 can lead as a negative consequence to an undesired or
anomalous sliding between the carcass plies and the bead
cores during shaping to toric configuration.

5 Further it is known to expand the carcass plies against
the bead cores forcing said bead cores to penetrate into
appropriate cavities or seats already provided at the
ends of the cylindrical drum for performing the first
step.

10 These cavities can have a rectangular configuration in a
plane axial to the drum or a different configuration, for
example, with the lateral walls axially outermost to the
drum, inclined, so that during the expansion of the whole
15 drum surface the bead cores in moving nearer to each
other penetrate more and more into the cavities.

These solutions have the drawback of causing during the
expansion sliding of the carcass ply from the two ends
20 of the drum towards the center.

In fact, the ply must penetrate into the cavities and is
obliged to follow a longer run with respect to the
original one when it is arranged on the drum and since
25 the ply has the same length, as already said, must
remain subjected to sliding actions from the bead core
outside towards the inside.

Unfortunately, in this case owing to the friction of the
30 materials in contact with one another it is possible to
have non controllable relative movements between the
carcass ply or plies and bead cores with possible into-
lerable abrasion conditions in the materials.

- 1 Then, in case of inclined walls in each cavity possible
stumbles of the bead cores take place during the
approaching step with unavoidable deviations of the plane,
within which the bead cores lie, from the predetermined
5 optimal orientation perpendicular to the drum axis, the
whole with unacceptable consequences for a regular
formation of the beads in a pneumatic tire.

Therefore, the present invention aims to provide a
10 process and relative device for manufacturing pneumatic
tires devoid of the cited drawbacks.

One object of the present invention is a process for
manufacturing pneumatic tires comprised by a carcass
15 formed by one or more reinforcing plies, a tread and an
annular reinforcing structure between carcass and tread,
comprising the steps of:

- 20 a) preparing a carcass according to a cylindrical shape
on a building drum;
b) applying the bead cores at a distance around the
carcass at a predetermined position from the two ends
of the drum, with the axes of the bead cores aligned
with the carcass axis, and
25 c) expanding the carcass while maintaining cylindrical
configuration to advance it into contact with the
bead cores;

30 said process being characterized by the fact of
comprising the steps of:

- d) drawing the bead cores towards each other along the
direction of the axis of the carcass, with maintaining
35 them in planes perpendicular to the carcass axis,

- 1 together with the same portions of plies already
blocked against the inner surface of the bead cores
in step c;
- 5 e) expanding further and again maintaining cylindrical
configuration the carcass zone comprised between the
bead cores for pressing the carcass plies to the
axially inner side of the bead cores;
- 10 f) expanding the carcass zone laterally to the bead cores
for pressing the carcass plies to the axially outer
side of the bead cores; and
- g) shaping the carcass to toric configuration as known
and effecting the step of turning up the carcass ends
to the sidewalls of the carcass shaped to toric
configuration.

15

Steps d), e) and f) are the essential steps for the purposes of the invention and guarantee advantageously an optimal preliminary condition for a regular formation of the beads of a pneumatic tire.

20

In fact, the approaching of the bead cores is effected only after having established by the expansion of the carcass ply a real welding between the portions of the ply itself and the inner surface of the bead cores;

25

consequently the process according to the invention excludes the raising of any movement between the ply and the bead cores.

30

In other words, the axial movement of the bead cores takes place without causing rubbing and abrasion phenomena between the uncured elastomeric material of the carcass ply and of the covering of the bead core.

35

1 Moreover according to the process of the invention after
step d), since there has been no relative movement be-
tween the carcass ply and the bead cores, the quantity
of ply present from the points of contact with the bead
5 cores towards the two ends, is still that established
originally and has an equal value on both sides, so that
the final step of turning up the ply on the bead cores
made with any whatsoever known method, will give rise
to two beads equal to each other and of the desired
10 consistence.

The further essential step of expanding the ply comprised
in the space defined by the two bead cores assures then
the deformation of the ply on the inner sides of the
15 bead cores and this characteristic in combination with
the deformation of the ply on the outer sides of the
bead cores, effected in any whatsoever step previous or
subsequent to that now described, provides an inseparable
anchoring between the ply and the bead cores also under
20 the stronger thrusts or forces exerted on the central
portion of the ply in the final step of shaping the
carcass in a known way to toric configuration.

Also in this further cited essential step, advantageously
25 there is no sliding of the ply from the outside of the
bead cores towards the inside since the quantity of ply
brought against the inner sides of the bead cores is a
portion of ply comprised between the bead cores and is
supplied by the relative approaching of the bead cores
30 in the direction of their axes.

Therefore also this step guarantees the formation of two
beads of equal rigidity.

1 Preferably the process is characterized by the fact that
the main steps d) and e) are performed at the same time.
Practically, the bead cores are approached and simul-
taneously the carcass expands between the bead cores
5 up to a new cylindrical configuration.

The process can be performed in a single step up to the
toric configuration of the carcass or in two steps, name-
ly shaping the carcass, first in cylindrical configura-
10 tion and then to toric configuration.

In particular when the process of the invention is per-
formed in two steps, the blocking of the carcass ply on
the sides of the bead cores permits a sure and immediate
15 centering operation of the carcass itself in the zone of
the bead cores on the bead seats of the drum used in the
second step.

A further object of the present invention is a drum for
20 building up carcasses of pneumatic tires comprising at
least a reinforcing ply wound in the form of a sleeve on
the drum and a pair of bead cores arranged around the
drum and at a distance from said ply in proximity of the
ends with the axes of the bead cores aligned with the
25 drum axis, said drum being characterized by the fact that
it comprises at least three distinct and separated parts,
a central part and two lateral parts, said parts being
in cylindrical configuration are simultaneously radially
expandable in equal amounts with respect to the axis of
30 the drum, said amounts being correspondent to the carcass
ply blocked between the said lateral parts and the inner
surface of the bead cores, said central part being still
in cylindrical configuration is more radially expandable
with regard to and subsequently to the maximum radial
35

1 expansion of said lateral parts to block said ply against
the bead cores, and said lateral parts can be approached
toward each other in axial direction of the drum when the
carcass ply is blocked against the bead cores.

5

The present invention will be better understood by the
following detailed description made by way of a non
limiting example with reference to the figures of the
enclosed sheet of drawing in which

10

figure 1 shows in a transversal partial view a drum for
performing the process of the invention;

15

figures 2 to 4 show subsequent working steps of
the drum of figure 1.

20

Now it is explained a process and relative device for
manufacturing a pneumatic tire, for example, of the type
comprising a radial carcass constituted by a single ply
or by a plurality of plies to be turned up around a pair
of bead cores (for example having circular section), an
annular reinforcing structure and a tread.

25

The process for manufacturing the pneumatic tire is
performed by making use of two drums, the first of which,
drum 1, figure 1, constitutes one object of the present
invention and is related to the manufacture of the
carcass according to a cylindrical configuration, the
second of which (not shown) is of the expandable type for
shaping the carcass to toric configuration and is not be
shown since it may be of any known structure.

30

35

The drum 1 is rigid, substantially cylindrical and
rotates around a shaft indicated in figure 1 by the
axis of rotation 2.

- 1 In its more general aspects, the drum 1 comprises at least three distinct parts, a central part 3 and two lateral parts 4, 5.
- 5 Said parts 3, 4, 5 are apt to form the seats for blocking the carcass plies and the further elements, usually arranged in annular configuration around the plies, against the bead cores already arranged at a predetermined distance around the drum 1 and already provided, if desired, with the relative elastomeric fillers.
- 10

According to a characteristic of the invention the two seats of the drum 1 must still be formed when the drum 1 is in the starting cylindrical configuration corresponding to the arrangement of the carcass plies (figure 1).

15

The construction of the seats, i.e. the formation of their bottom and the two lateral walls, is carried out subsequently when, as explained later, it is desired to establish the blocking of the plies not only on the base, but also on the opposite sides of the bead cores.

20

The drum parts 3, 4, 5 are formed by a plurality of sectors forming a cylindrical configuration and being simultaneously and radially movable in equal amounts to bring the carcass plies into contact with the inner surface of the bead cores C_1 , C_2 .

25

The central part 3 is then further on radially movable, always in cylindrical configuration, as regards the maximum expansion position reached by the lateral parts 4, 5 to bring the plies into contact with on side surface of the bead cores C_1 , C_2 (figure 3).

30

- 1 Also, the invention provides a further possibility of axial and no longer radial movement of the lateral parts 4, 5.
- 5 In the preferred embodiment the lateral parts 4, 5 are separated from the central part 3 by a predetermined distance and it is foreseen that a portion T of said distance is annulled during the operation of the drum 1.
- 10 Moreover, elongated elements 6 of known type are arranged in association with the lateral parts 4, 5; said elements 6 are connected to the sectors by means of hinges 7 and above said elements 6, there is arranged an expandable continuous cylindrical annular covering 8, which is
- 15 preferably constituted by a closed bag having annular configuration, said bag being known in the mechanism for turning up the carcass plies and comprising a lateral extension as a single layer applied with one end 9 to the central part 3 of drum 1.
- 20 Practically, as it will be clear during the operation, the bag 8 and the end 9 are arranged in such a way that the expansion of the bag 8 takes place freely towards the outer side of the bead core C and said elements constitute
- 25 therefore in the described and illustrated embodiment a further means in combination with the presence of the elements 6 to obtain a compressive radial expansion effect of a portion of the lateral part 4 or 5 greater than that of the remaining portion of the same lateral part apt to
- 30 constitute the cylindrical bearing seats for the bead core base.
- Clearly, the radial expansion to deform the plies on the outer sides of the bead cores C could be obtained also in
- 35

1 another way, for example, with another set of sectors
arranged at the side of the sectors of the lateral
parts 4 and 5.

5 In this case, the further set of sectors follows the
sectors of the lateral parts 4 and 5 in their axial
movements, whereby again the lateral parts in a first
radial expansion bring the plies in contact with the
base of the bead cores and at last said further set of
10 sectors greatly expands with respect to the lateral parts
to bring the plies on the outer sides of the bead cores.

In the illustrated embodiment the sectors of the lateral
parts 3, 4, 5 and the elements 6 comprise means for their
15 actuation, not shown in the drawing since they do not
constitute an essential part of the invention.

Only by way of example, there is cited here briefly the
possibility of effecting the radial movements of the
20 sectors with fluid dynamic means apt to transform an
axial thrust of a stem, acting along the shaft of the
drum, into a radial thrust transmitted to the sectors.

Also there is cited, as suitable for the said purpose,
25 a known embodiment in which there is foreseen a trans-
mission of motion with a horizontal rack acting along
the shaft and a vertical rack connected to the sectors,
or also a further embodiment in which the movement of
a cam having an inclined surface, moved by a piston
30 obliges a wheel integral with a sector to slide on the
profile of the cam.

Otherwise to what cited, the means for causing radial
movement of the sectors could be realized with inflatable
35

1 small bladders according to known techniques used in building drums.

5 The means for causing axial movements of the lateral sectors towards the central sector to annul the distance T can be also realized with fluid dynamic controls in which a cylinder connected to the shaft transmits through the stem a thrust to a sleeve arranged around the shaft and comprises guides in which the sectors moved
10 by the inflatable small bladders radially slide.

The angular movement of the elements 6 can be obtained with cylinder and piston means acting on the element 6 or on levers connected to the element 6.

15

Now there is described the process for manufacturing a radial tire according to the principles of the invention.

20 On the drum 1, being in the starting cylindrical configuration; i.e. with seats still to be formed, and placed under rotation, there are arranged, (figure 1) symmetrically with respect to the midline of the drum 1, the various elements forming the carcass, from the outer ones, with respect to the finished tire, to the inner-
25 most ones, i.e. the sidewalls, the reinforcing strips, the carcass plies.

30 In the figures of the text, for sake of simplicity, all the elements have been collected in a single layer L and it has been supposed that the distance of the sectors of parts 3, 4, 5 from the axis is Z and is the same for all the sectors.

35

1 On the thus formed carcass sleeve there are arranged the bead cores C_1 and C_2 already associated, if desired, with the related elastomeric fillers.

5 In figure 1 the bead cores C_1 and C_2 are supposed to be at a distance K from the ply L . The assembly of the bead cores C with the fillers is kept in position by suitable known devices acting, for example, on the opposite sides of the filler with suction means or with jaws or with
10 similar elements applied on opposite parts either of the bead cores or of the fillers. Said devices are not illustrated since they do not constitute an object of the present invention.

15 Now there are described the steps for blocking ply L on the bead cores C . At first, there is caused synchronous and equal radial expansion of value K of all the central and lateral sectors until carcass ply L is blocked and forced against the innermost portion of the base surface
20 of the bead cores C (figure 2).

During these steps, the carcass ply L has become expanded favourably with an increase of the diameter between 5 and 10 % without dragging action or traction action
25 exerted on the portion of the ply L arranged on the lateral sectors with respect to that arranged on the other parts of the drum 1 as it could have been possible in this step if only the lateral sectors were expanded radially with respect to the central sectors. Therefore,
30 there is no sliding of the ply L and of the other elements with respect to the bead cores C .

Also, very advantageously in this step there is a uniform moulding of the carcass ply L in the compression zone
35

1 against the bead cores C.

In fact, in the described solution the sectors of the lateral parts 4, 5 first in contact to each other and then expanded and separated, expand the elastic covering 8 so that also the layer thereof lying below ply L is continuous and the stresses on the material of the plies are distributed practically in a regular way.

10 In a further subsequent step, there is effected a further radial movement of expansion of the sectors of the central part 3 and at the same time there is determined an axial movement of the lateral parts 4, 5 towards the part 3 tending gradually to annul the distance T (figure 3).

15 During the movement of the lateral sectors, also the elements 6 move, these latter following the movements of the lateral sectors as permitted to them by the hinged connection 7 both in the first step and in the latter
20 step.

During this step very advantageously the carcass plies (ply L) and the other elements arranged as annular bands do not undergo slidings with respect to the bead cores
25 C.

In fact the plies L have already been blocked during the previous step against the bead cores C and now the bead cores C in parallel lying planes move axially towards
30 the inside together with the plies, with a predetermined axial movement T equal to the radial movement of the sectors of the central part 3.

In substance, the distance T between the central sectors
35

1 and the lateral ones is chosen at the beginning so that
the radial expansion of the central sectors permits to
press the plies L on the inner side of the bead cores C
without causing tractions or dragging actions of the
5 ends of the plies L from the outside of the two bead
cores C.

In practice, there is indicated with H (figure 3) the
maximum transversal dimension of the bead core C measured
10 in a plane axial to the drum 1, and the portion of ex-
panded ply L can occupy any one position starting from a
value equal at least to 20 % of H up to values also
higher than H. In the described example, the portion of
expanded ply L passing from the position of figure 2 to
15 that of figure 3, occupies a position comprised between
40 and 60 % of H, for example, about 50 % of H.

In a further step, the plies L in contact with the outer
sides of the bead core C are pressed and precisely:

20

- first, fluid under pressure is sent into the bag 8
(figure 1) obliging this latter to expand with a profile
determined by its particular lying with respect to the
bead core C;

25

- then all the elongated elements 6 are rotated around
the relative hinges 7 (figure 4) so that the elements 6
press with force the bag 8 against the plies L which on
their turn get deformed going into contact with the
30 outer side of the bead core C.

The cited steps are effected contemporaneously at the two
ends of the drum 1.

35

1 In the further steps, there are effected the contraction
of the various parts of the drum 1, the removal and the
transport of the carcass from the drum 1 of figure 1 to
the expandable drum for performing the second step.

5 At last, with known modalities not repeated here, there
are effected the further steps of shaping the carcass
to toric configuration, of turning up of the plies on the
sidewalls of the toric carcass, and of applying the
10 reinforcing annular structure and the tread.

During the toric shaping of the carcass, owing to the
considerable anchoring of the plies L to the sides of the
bead cores C, any sliding of the plies L themselves with
15 respect to the bead cores C, as occurred in the state of
the art, is favourably avoided.

Consequently, the beads of the finished tire show the
desired geometrical configuration and stiffness.

20 As a demonstration of the invention of the present process
it is stressed how the step of applying the plies L on
the axially inner sides of the bead cores C takes place
without movement thereof from the end towards the center.

25 This characteristic is exactly the contrary of what happens
in the state of the art, where the radial expansion of
the whole drum surface, comprising the cavities for the
bead cores already preconstituted, obliges the ply to
30 slide with respect to the bead core to conform itself
less or more to the profile of the cavity retiring from
the ends of the drum.

The process according to the invention as already ex-
35 plained does not require the returning of the ply L from

1 the ends of drum 1 since after having bound with a first
expansion the base of the bead core C to the underlying
ply portion in an invariable manner for the further
duration of the same process, it provides the ply L to
5 be deformed against the inner sides of the bead cores C
through an axial approaching of the bead cores C to which
said underlying portions of ply L are anchored.

Consequently an axial movement of the said portion of
10 plies L anchored to the bead cores C constitutes an
essential characteristic to permit a perfect anchoring
of the plies L on the inner sides of the bead cores C and
said characteristic is very unexpected since one should
have expected in obvious way that the anchoring of the
15 plies on the inner sides of the bead core involved only
radial movements and not also a movement in an axial
direction where among other things, according to a
solution of the state of the art cited here, it was
possible to verify undesired slidings and rubbings
20 between plies and bead cores.

Although the present invention has been described with
respect to a preferred embodiment, it is understood that
the invention includes in its scope any other alternative
25 embodiment accessible to a technician of this field.

30

35

1 What is claimed is:

1. Process for manufacturing pneumatic tires comprised
by a carcass formed by one or more reinforcing plies, a
5 tread and a reinforcing annular structure between carcass
and tread, comprising the steps of:

- a) preparing a carcass according to a cylindrical con-
figuration on a building drum;
- 10 b) applying the bead cores at a distance around the
carcass at a predetermined point from the two ends
of the drum, with the axes of the bead cores aligned
with the axis of the carcass,
- 15 c) radially expanding the carcass maintaining the
cylindrical configuration up to advancing it into con-
tact with the bead cores;

said process being characterized by the fact of comprising
the steps of:

20

- d) drawing the bead cores near each other, along the
direction of the axis of the carcass with lying planes
perpendicular to the axis of the carcass, together
with the portions of the carcass plies already blocked
25 against the inner surface of the bead cores in step
c;
- e) radially expanding further on and still maintaining
the cylindrical configuration the carcass zone com-
prised between the bead cores for pressing the carcass
30 plies on the axially inner sides of the bead cores;
- f) radially expanding the carcass zone laterally of the
bead cores for pressing the carcass plies on the
axially outer sides of the bead cores; and
- 35 g) shaping the carcass to a toric configuration as known

1 and effecting the step of turning up the carcass ends
on the sidewalls of the torically deformed carcass.

2. Process as in claim 1,
5 characterized by the fact that the steps d) and e) take
place at the same time.

3. Process as in claim 1 or 2,
characterized by the fact of expanding the said plies in
10 correspondence of the radially innermost surface of the
bead core with an expansible elastic continuous covering
arranged in annular form at the ends of the drum.

4. Process as in any one of the preceding claims,
15 characterized by the fact of expanding and compressing
said plies on the outer sides of the bead cores with an
elastic bladder arranged annularly at the end of the drum
by expanding said bladder freely in a lateral position
outside of the bead core.

20 5. Process as in any one of the preceding claims,
characterized by the fact of expanding the reinforcing
ply comprised between the bead cores up to a position at
least equal to 20 % of the maximum transversal dimension
25 of a bead core measured in an axial plane of the carcass
and preferably comprised between 40 % and 60 % of said
maximum transversal dimension.

6. Drum for building up carcasses of pneumatic tires
30 comprising at least a reinforcing ply (L) wound in the
form of a sleeve on the drum (1) and a pair of bead
cores (C_1 , C_2) arranged around the drum and at a distance
from said ply in proximity of the end with the axes of
the bead cores aligned with the axis of the drum, said

35

1 drum being characterized by the fact of comprising at
least three distinct and separate parts (3, 4, 5), a
central part (3) and two lateral parts (4, 5), said
parts being in cylindrical configuration are simultaneous-
5 ly and radially expandable in equal amounts with respect
to the axis of the drum, said amount being correspondent
to the carcass ply blocked between the two lateral parts
and the inner surface of the bead cores, said central
part being more radially expandable in cylindrical con-
10 figuration with regard to and subsequently to the maximum
expansion of the said lateral parts to block said ply
against the bead cores, said lateral parts can be
approached toward each other in axial direction of the
drum when the carcass ply is blocked against the bead
15 cores.

7. Drum as in claim 6,
characterized by the fact of comprising means (8) for
radially expanding the ply on the outer sides of the
20 bead cores.

8. Drum as in claim 6 or 7,
characterized by the fact that said lateral parts (4, 5)
are at a distance (T) from the central part (3) and
25 axially movable to annul said distance.

9. Drum as in any one of the preceding claims,
characterized by the fact that said expandable parts (3,
4, 5) are formed by sectors.

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10. Drum as in claim 9,
characterized by the fact of comprising means for the
radial movement of the sectors.

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